**Re: Request for Formal Response to Industry-wide Entrainment Study Plan**

**Willie Lane** to: joe.p.smith
Cc: Isaac Chen, Jamie Hurley

11/23/2009 04:21 PM

Greetings Joe, and wishes for a happy holiday. As promised I am forwarding EPA's remaining comments on the proposed. Entrainment Study Plan. We recognize the effort and level of planning that went into this proposal. Many of our comments, we believe, can be addressed through inclusion of some additional information. If you have questions or require clarification of comments please contact Isaac Chen at chen.isaac@epa.gov or me as given below.

EPA comments on E-study.doc

Willie Lane
Chief, Permits and Technical Section
EPA Region 6
Phone: 214.665.8460
Fax: 214.665.2191

## *Sampling Design and Methods*

***Sampling locations***

The CSA proposal aims to provide an industry-wide study to fulfill the requirements for entrainment monitoring in Section I.B.12.d of the OCS General Permit (EPA 2007). According to the permit, an industry-wide study may include a smaller, statistically representative number of facilities. CSA proposes to perform site-specific entrainment monitoring at 3 facility locations, to be determined in collaboration with the Offshore Operators Committee CWIS Steering Group. The CSA proposal does not specify which facilities are preferred, their locations, or how they will be chosen. Moreover, the proposal does not specify the spatial location of the sampling sites with respect to the facility intake structures, although a memorandum from LGL Ecological Research Associates to ExxonMobil (Gallaway 2009) indicates that samples will be obtained upstream of the intakes.

Several factors may influence the representativeness of facility-specific sampling, including CWIS design, ichthyoplankton assemblage characteristics, and oceanographic properties, among others. The Gallaway memorandum (Gallaway 2009) indicates that planktonic densities and composition are remarkably homogenous along isobaths throughout the Gulf of Mexico. The memorandum also describes the three proposed sampling sites as being located in "biogeographic zones C4 (east of and near the Mississippi River influence), C5, and W5" where the C4 represents the continental slope with water depths varying from 200 – 1000 m, and C5 and W5 represent the deepwater Gulf with water depths >1000 m. Without further information regarding the similarity (or lack thereof) of the facility designs and oceanographic characteristics, it is not possible to evaluate the representativeness of the sampling locations for any given proposed or existing facility.

Ichthyoplankton typically demonstrate significant vertical, horizontal, and temporal variability, however, based on the available information, there seems to be more uncertainty regarding seasonal patterns of ichthyoplankton in the Gulf than spatial patterns. CSA proposes to collect depth-stratified samples from one location at each facility to address the vertical variability, and relies on SEAMAP results showing ichthyoplankton homogeneity along isobaths to address the horizontal variability. To address seasonal and diel variability, CSA proposes to collect biweekly sampling at three times of day during each sampling event (dawn, mid-day, and dusk). It is important that the sampling program maintains at least this frequency to sufficiently characterize temporal variability.

Although the sampling strategy appears adequate for any single platform, it is unclear that sufficient samples will be collected to adequately characterize the site-specific conditions at each CWIS (especially those to which this industry-wide study might be applied). The

geographic spread, potential differences in facility design, and potentially heterogeneous placement of platforms may reveal the sampling program to be inadequate. Further discussion of sampling site selection with respect to other facilities that may rely on the results of the study is required to evaluate whether or not the sites are representative and sufficient for an industry-wide application.

***Sampling and identification methods***

The CSA proposal (page 8) describes the ichthyoplankton tows as 100-ft (30-m) stepped oblique tows, with the first net open from the surface down to approximately 700 ft (213 m). The second net would open at approximately 700 ft; the third at 328 ft (100 m) and the fourth at 33 ft (10 m). Figure 3 depicts the third and fourth nets as opening at approximately 465 and 230 ft (142 and 70 m), respectively. It is unclear from these descriptions how the samples will be stratified by depth. The MOCNESS net system is capable of collecting up to eight separate vertical samples in a single tow. Further discussion and justification is warranted for the depth intervals selected.

Laboratory sorting and identification methods described in Appendix A of the proposal generally follow EPA guidelines and industry standards. Identification will include fish eggs and larvae, shrimp larvae, and crab megalopae, all of which will be identified to the lowest practical taxonomic level. At least two samples from each collection period (presumably equal to each biweekly sampling event, consisting of a total of 27 samples) will be re-examined by a second sorter to evaluate sorter efficiency, and the accuracy of the subsampling estimate will be determined. However, identifications are not subject to quantitative quality control. Questionable identifications will be verified by independent experts, but no independent analysis to verify taxonomic identification appears to be planned. Quantitative quality control measures for taxonomic identification would improve quality of the study.

## *Entrainment Impact Assessment*

CSA proposed to estimate site-specific entrainment impacts using both absolute levels of entrainment (number entrained by taxon), and demographic assessment models designed to place the impacts into context in terms of population losses. Two assessment models are proposed: the Equivalent Adult Model (EAM) and the Fecundity Hindcasting Model (FHM). The EAM uses life stage-specific (natural) mortality data to estimate the numbers of adult fish that would have been produced from the eggs and larvae, had they not been entrained. The FM also uses life stage-specific (natural) mortality data to estimate the number of adult females at the age of maturity whose reproductive output was lost due to entrainment.

Both the EAM and FHM require life stage-specific mortality data: EAM requires data from the age at entrainment to adult, and FHM requires data from the egg to the age at entrainment. Additionally, the FHM requires fecundity estimates, knowledge of the age of the female at sexual maturity, and longevity. These data may or may not be available for specific taxa. The proposal indicates that CSA plans to acquire life history data from the scientific literature, and

in particular from the marine aquaculture literature. Life history data from aquaculture studies may not be representative of life history parameters for wild fish in the Gulf of Mexico.

In addition to limitations raised by lack of species-specific data, and the uncertainty resulting from estimating these data, each of these models assumes that mortality is not density dependent, that life history parameters are constant across the geographic range of the study, and that populations are in equilibrium. Differences between these assumptions and actual population and life history characteristics may result in either under- or overestimates of the numbers of adult fish impacted, depending upon the species, the parameter affected, and the direction of the difference. In general, using life history data from different species or applying data collected from aquaculture fish will decrease the accuracy of the model's predictions. The reasons for selecting specific model inputs should be clearly identified and justified so that the results can better be interpreted by regulators.

### *Comparisons with SEAMAP Data*

CSA proposes to compare ichthyoplankton population densities and community indices across three spatial resolutions: SEAMAP regional data; SEAMAP proximate data (consisting of 3 30-minute blocks); and site-specific data collected during the study. Both univariate and multivariate methods are proposed. The proposal states that if these assessments yield similar results, site-specific sampling at the resolution required by the monitoring plan may not be required for offshore oil and gas facilities: using SEAMAP data as a substitute for site-specific entrainment data may be sufficient.

We reviewed the comparability of SEAMAP's data collection and analysis (Lyczkowski-Shultz 2004) with the proposed methods for this study (Table 1). SEAMAP uses oblique tows from surface to bottom or from surface to the maximum depth limit of their gear. Therefore, SEAMAP methods do not specifically address density versus depth issues. CSA proposes to eliminate the density-depth issues by calculating a mean density over all depths combined for site-specific samples. Since CSA proposes to sample to approximately the same depths as SEAMAP, using comparable protocols, the depth-integrated data should be comparable.

However, SEAMAP data differ significantly in temporal elements (duration, frequency, and specific timing of sampling) in comparison with the proposed study. The SEAMAP program has been sampling the Gulf of Mexico since 1982, providing almost 30 years of data. Over the last 30 years, it is likely that ichthyoplankton densities have changed because of changing regulations that impact environmental conditions and fisheries pressures (either positively or negatively). Therefore, not all 30 years of data may be appropriate for use in a comparison.

SEAMAP surveys occur in spring, summer, late summer/early fall, and fall (see Table 1). Due to logistic constraints, not every site is sampled every year, nor is every site sampled once every season. In fact, the spring survey covers only open waters (within the US Exclusive Economic Zone), while the summer and fall surveys encompass only continental shelf waters from off

southern Texas to Mobile Bay, and late summer/early fall surveys encompass the coastal region off southern Texas to off southern Florida. CSA proposes to categorize the data by year, season, and month to explore whether these variables contribute significantly to variability in the density data.

SEAMAP does not collect samples from December through March, winter-spawning species likely will be absent from the SEAMAP database. Therefore, no comparisons can be made for any species not represented or significantly underrepresented in the SEAMAP data.

We did not conduct an independent review of SEAMAP's spatial variability; instead we rely on CSA's statement that ichthyoplankton are homogenous along isobaths. However, we note that SEAMAP stations are located at 30-nautical mile intervals across the Gulf of Mexico. Large-scale sampling of this nature will be unable to detect fine-scale local variations. Additionally, ichthyoplankton are not homogenous across all ocean depths: they occur in greater densities along the continental shelf than in deep ocean waters. The proposal does not indicate how the comparison will be stratified or otherwise adjusted for ocean depth.

CSA's proposed statistical analyses appear to be both comprehensive and appropriate for comparing the SEAMAP and site-specific datasets.

**Table 1. Comparison of SEAMAP's data collection and that of the proposed study.**

| | Proposed Study | SEAMAP |
|---|---|---|
| Sampling season | Year-round | Spring (April to early June)<br>Summer (June and July)<br>Late summer/early fall (September)<br>Fall (October and November) |
| Sampling frequency | biweekly | Varies, typically less than once per season<br>SEAMAP surveys do not encompass the spawning seasons of all fish species; most of the winter-spawning exploited resources in the Gulf of Mexico are not included. |
| Sample timing | Dawn, mid-day, and dusk | Varies (upon arrival at the station) |
| Gear | MOCNESS net system: 1.0 m x 1.4 m rectangular net frame, towed at an angle for a 1.0 m2 sampling area, and fitted with 0.333 mm mesh netting. | Bongo net array: pair of mated 61-cm diameter net frames, for a 0.57 m2 sampling area, and fitted with 0.335 mm mesh netting |
| Tow | 100-ft (30-m) stepped-oblique tows<br>Text describes the first as from surface down to 700 ft (213 m); second from 700 ft (213 m) to 328 ft (100 m); third from 328 ft to 33 ft (10 m); and fourth from 10 m to surface.<br>Figure 3 indicates the first tow is from surface down to 700 feet; second is from 700 ft to ~465 ft; third is from ~465 ft to ~230 ft; fourth is from ~230 ft to surface. | An oblique tow path to a maximum depth of 200 m, or to 2-5 m off the bottom in depths less than 200 m. |
| Laboratory | Targeted taxa (fish eggs and larvae, shrimp | Fish larvae were identified to the lowest |

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|---|---|---|
| analysis | larvae, and crab megalopae) will be identified to the lowest possible taxon and enumerated. | practical taxonomic level (typically family). Fish eggs were not identified. No winter-spawning exploited resources species included |

Page 6 third paragraph, document states "the vessel will then transit to the **westernmost study site** offshore Alabama...." This statement is confusing given that sampling begins west of the Alabama site, off the Louisiana coast.

Page 6 Sampling Logistics- It is recommended that complementary chemical/physical data be collected along with the larval fish collections. Larval fish tend to congregate at a certain range of conditions dependent on temperature, DO, salinity, depth, etc. Parallel collection of chemical parameters might be useful in explaining the variability in the frequency and abundances of larval fish and eggs. This information might aid in mitigating the effect of the intake structures (determining depth placement) as a strata of water's chemical and physical characteristics may be less preferred by most larval fish species.

Finally, many of the design decisions proposed in the plan are predicated on life history information that is insufficient or in some cases absent. EPA believes that the proposed plan would be strengthened if it underwent a broader peer review by experts in marine ecology and early life stages of fish.

## *Citations*

Environmental Protection Agency (US). NPDES General Permit for discharges from the Offshore Subcategory of the Oil and Gas Extraction Category for the Western Portion of the Outer Continental Shelf of the Gulf of Mexico off the coasts of Louisiana and Texas. Final Notice. 2007 Jun 7. Federal Register 72(109): 31575 – 31578.

Gallaway, Benny J. (LGL Ecological Research Associates, Inc., Bryan, TX). Memorandum to: Joseph P. Smith (Chairman, CWIS Steering Group, ExxonMobil Upstream Research Company, Houston, TX). 22 Oct 2009.

Lyczkowski-Shultz, J., D.S. Hanisko, K.J. Sulak, and G.D. Dennis, III. 2004. Characterization of Ichthyoplankton within the U.S. Geological Survey's Northeastern Gulf of Mexico Study Area - Based on Analysis of Southeast Area Monitoring and Assessment Program (SEAMAP) Sampling Surveys, 1982-1999. NEGOM Ichthyoplankton Synopsis Final Report. U.S. Department of the Interior, U.S. Geological Survey, USGS SIR-2004-5059.